

ART. V.—*Note on the Evidence of Age of the Dacites and Associated Igneous Rocks in the Marysville-Taggerty District, Victoria.*

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Introduction.

The purpose of this note is to record the observation of some significant facts bearing on the question of the age of the dacites and associated igneous rocks in the Taggerty and Marysville districts in north-western Gippsland, and hence on the age of similar rocks in other parts of Victoria. The conclusions reached are as yet tentative, and finality will not be approached until after the completion of further palaeontological and petrological research. It was thought, however, that some indication of a probable future change of ideas ought to be presented, in view of possible effects on the work of other geologists.

Summary of Results.

(a) TAGGERTY.

While investigating the igneous rocks of the Blue Hills, Taggerty, last year, I was lucky enough to find a fossiliferous bed in sediments underlying a thick rhyolite sheet forming the summit of that range. The following forms were subsequently described (1):—

Ostracodermi. *Bothriolepis gippslandiensis* Hills, 1929.

Dipnoi. *Eoetenodus microsoma* Hills, 1929.

Holonema cf. *rugosum* (Claypole, 1883).

It was shown that this assemblage is a typically Upper Devonian one, the genera *Bothriolepis* and *Holonema* never occurring outside that series in any other part of the world, and the characters of the new genus *Eoetenodus* being such as to be in accord with a determination of its age as older than any known *Ctenodus*, which genus first occurs in the Lower Carboniferous (*C. interruptus*, Carboniferous Limestone and Calciferous Sandstone of Fifeshire and Midlothian).

The presence of beds of Upper Devonian age in this locality had not been previously suspected, and since it was known that normal Palaeozoic dacites occurred to the east of the rhyolites as well at Marysville and Narbethong to the south, the very interesting question of the relation of the rhyolites and sediments to those dacites was opened up.

It was noted that at Narbethong very similar rhyolites, outcropping in an analogous way, had been described by Junner (2) as underlying and congenetic with the dacites, and further that Junner had compared the rhyolites with those at Mt. Wellington described by Teale (3) as underlying conformably Lower Carboniferous or Upper Devonian sandstones. Thus the implication was that the dacites are of Lower Carboniferous or Upper Devonian age.

Further collecting in the Taggerty district has resulted in the discovery of many well preserved though isolated placodermatous plates, the greater proportion of which are referable to *Bothriolepis*. The species *B. gippstandiensis* was founded on a detached median occipital plate and portion of a pectoral appendage, the first showing the V-shaped course of the sensory groove, and the latter the strong denticulations characteristic of *Bothriolepis*. The newly obtained material includes a pre-median plate, pectoral appendages and body plates, as well as another median occipital. Where these plates have any distinguishing characters of generic importance they are referable to *Bothriolepis*, and the presence of a remarkable median dorsal crest links them closely with *B. cristata* of the Upper Old Red Sandstone of Scotland, for which neither the median occipital nor the pectoral appendages have yet been described in detail.

Some fragments of a smaller placoderm with an ornament of fine concentric rugae were also obtained, as well as small pieces of plates or scales with an ornament similar to that of the large plate previously (1) referred to *Holonema*.

(b) MARYSVILLE.

The southerly extension of the Upper Devonian rocks of Taggerty has been recognized at Marysville, where the formations preserve their distinctive characters practically unchanged. The sequences in the two localities are as follows:—

Taggerty.	Marysville.
5. Rhyolite <i>a</i> .	5. Rhyolite <i>a</i> .
4. Rhyolite <i>β</i> .	4. Rhyolite <i>β</i> .
	Andesite. ? position.
3. Melaphyre.	3. Melaphyre.
2. Tuffs and fossiliferous sediments.	2. Tuffs, as yet barren.
1. Basal conglomerate.	1. Basal conglomerate.
-----Unconformity.-----	
Silurian, Cathedral Beds in part.	Silurian.

The outcrop of the rhyolite *a* at least is continuous between the two areas, but the intervening part was not studied in sufficient detail to permit of the recognition of the other formations, although east of Buxton the rhyolites *a* and *β*, the melaphyre, and the basal tuffs were seen (1).

The rhyolite *a*, which is very thick, and which forms the top of the steep escarpment marking the edge of the igneous rocks wherever they outcrop, has been traced south-west from Marysville to link up with the eastern edge of the area mapped by Junner, and there is thus no doubt that the correlation previously made between the Taggerty and Narbethong rhyolites from their descriptions and analyses is correct.

Junner's conclusion that the dacites overlie the rhyolites was confirmed. The latter outcrop everywhere marginally to the dacites, and may be seen to pass under them on the Wood's Point road and at Wilk's Creek. A few hours spent on the eastern side of the outcrop some thirteen miles from Marysville at Cumberland enabled me to recognize the rhyolites *a* and *β* as well as an andesite, overlying tufts which rest on the Silurian, and again forming a border to the dacites. The rhyolite is known to occur at the edge of the dacites east of Mt. Torbreck. These facts, together with the pronounced V'ing in the streams, show that we are dealing with a series of lava flows, of which the order of extrusion is melaphyre, (andesite), rhyolite *β*, rhyolite *a*, dacite. The dacites and rhyolites at Narbethong have been shown to be congenetic, and this is borne out by the field and microscopic relations of the Marysville rocks, so that we may group them together as an Upper Devonian series. Some evidence was also found of the intrusion of the granodiorites into the rhyolite *a*.

Discussion.

On petrologic grounds, the Marysville dacites have been linked with practical certainty with the Mt. Dandenong, Mt. Macedon, and Strathbogies dacites (4). The latter underlie sandstones supposed to be Lower Carboniferous (5), and overlie the Silurian, so that a Devonian age is indicated. They were placed in the Lower Devonian, it being believed that the igneous activity was associated with strong epi-Silurian fold movements in Victoria. The field relations at Tolmie, however, do not suggest the existence of an unconformity between the dacites and the sandstones as great as from the Lower Devonian to the Lower Carboniferous. Indeed, the relations seem very similar to those described by Teale (3) between the rhyolites and sandstones at Mt. Wellington. The many points of similarity between the Taggerty rhyolites and sediments and the rhyolites and "basal beds" of Mt. Wellington suggest their correlation, and thus we may link the normal dacites and rhyolites (Marysville, etc.), the Stratbogies-Whitfield dacites, and the Wellington rhyolites as Upper Devonian, leaving open the question of the age of the overlying sandstones and conglomerates.

With regard to the granodiorites which are often associated with the lavas, it has been shown that they intrude the latter at Belgrave (6), Narbethong (2), Marysville and Warburton (7),

but they have generally been placed very close to them in age, being merely the intrusive phase of the igneous paroxysm which gave rise to the acid lavas. However, evidence has been forthcoming that granodiorites in the Grampians are post-Lower Carboniferous (8), and in the Tabberabbera district "A big hypabyssal or small plutonic intrusion of diorite porphyrite occurs in the Middle Devonian rocks. . . ." Thus the ". . . long maintained view that notable compressive earth movements with accompanying plutonic intrusions ceased in the Lower Devonian period cannot now be entirely accepted." (9).

Conclusions.

Evidence has been adduced to show that the dacites and associated lavas of the Marysville-Taggerty district are of Upper Devonian and not Lower Devonian age, as was previously believed. This necessitates a revision of our conception of the age of the other Victorian dacites, and those that can be linked petrologically with the Marysville rocks must also be placed in the Upper Devonian, the associated granodiorites being correspondingly affected.

The foregoing statements have been made in a positive manner for the sake of clarity, although complete investigation of the evidence has not yet been made. I have to thank Dr. H. S. Summers for advice on various matters connected with this paper.

Bibliography.

1. E. S. HILLS. The Geology and Palaeontography of the Cathedral Range and the Blue Hills, in North-Western Gippsland. *Proc. Roy. Soc. Vic.*, n.s., xli. (2), pp. 176-201, 1929.
2. N. R. JUNNER. The Petrology of the Igneous Rocks near Healesville and Narbethong. *Ibid.*, xxvii. (2), pp. 261-285, 1915.
3. E. O. TEALE. A Contribution to the Palaeozoic Geology of Victoria, with special reference to the Districts of Mount Wellington and Nowa Nowa respectively. *Ibid.*, xxxii. (2), pp. 67-146, 1920.
4. H. S. SUMMERS. On the Origin and Relationship of Some Victorian Igneous Rocks. *Ibid.*, xxvi. (2), pp. 256-297, 1914.
5. ———. Geology of the Proposed Nillahcootie Water Conservation Area. *Ibid.*, xxi. (1), pp. 285-301, 1908.
6. E. W. SKEATS. The Gneisses and Altered Dacites of the Dandenong District (Victoria), and their Relations to the Dacites and to the Granodiorites of the Area. *Quart. Journ. Geol. Soc.*, lxvi., pp. 450-469, 1910.

7. ———. The Volcanic Rocks of Victoria. Pres. Address Sect. C., *Rept. Aust. Assoc. Adv. Sci.*, xii. (Brisbane Meeting, 1909), pp. 173-235, 1910.
8. ———. The Evidence of Post-Lower Carboniferous Plutonic and Hypabyssal Intrusions into the Grampian Sandstones of Western Victoria. *Proc. Roy. Soc. Vic.*, n.s., xxxvi. (1), pp. 50-57, 1923.
9. ———. The Devonian and Older Palaeozoic Rocks of the Tabberablera District, North Gippsland. *Ibid.*, xli. (2), pp. 97-120, 1929.